The Bombay Natural History Society/ World Health Organization Bird Migration Study Project

BY

SÁLIM ALI

Chief Investigator, BNHS/WHO Bird Migration Study Project

(*With four plates*)

INTRODUCTION

In March 1959 I attended, as a representative of the Bombay Natural History Society, the meeting of a Scientific Group of ornithologists and virologists convened at Geneva by the World Health Organization to consider the question of research on birds as disseminators of arthropod-borne viruses, and put forward a scheme for the establishment of a bird-ringing centre in the Rann of Kutch. This area seemed appropriate for the purpose in hand because a considerable portion of the birds migrating into India from the north-west, i.e. from eastern Europe, Siberia, and central and northern Asia, come down the Indus Valley and across the Great Rann into Kutch, Gujarat, and the Saurashtra peninsula. There is also evidence that Kutch lies on the eastern fringe of a broad stream of migration from central and northern Asia in a south-westerly direction in autumn (and vice versa in spring) across Afghanistan, Baluchistan, Sind, and the Arabian Sea into British Somaliland, Abyssinia, and further south. The outbreak of a form of encephalitis in the Kayasanur Forest area in Mysore, the virus of which was reported in 1957 to be related to a group of viruses occurring in Omsk in the U.S.S.R., suggested the possibility of its having been carried by migrating birds. The Scientific Group was impressed by the possibilities of the scheme and recommended it for the consideration of the General Body of the World Health Organization.

Pending the decision of the General Body I conducted a preliminary survey of the area in April 1959 to select possible sites for the field

stations, to investigate local conditions, and to estimate the requirements and plan the necessary details. The expenditure for the preliminary survey was met out of funds placed at the Society's disposal by the Rockefeller Foundation.

Preliminary Field Survey: Kutch, 6 to 13 April 1959

I visited Kutch between 6th and 13th April 1959. A jeep was hired from the Government Garage through the good offices and co-operation of the Ministry of Local Self Government & Public Health, Bombay, and of the Collector of Kutch. In all some 700 miles were covered during the week, and all the likely areas bordering the Great Rann, along the northern boundary of Kutch district, were visited in two separate trips. The first started from Bhuj north through the Banni to Khavda and Nir, travelling westward thence through Kuār Bēt, Dordha (2 miles south of Banri *jhil*), Hajipir, Lakhpat, and back to Bhuj; the second from Bhuj eastwards through Anjar, Bhachau, Gandhidam, Chitrod to Rapar, and thence through Fatehgadh, Mouana, Bela, Bālāsar, and Desalpur, back to Rapar, and to Bhuj. Unfortunately Khadir Island could not be visited as the shortest route across the Rann from Chobari was still impassable owing to its being wet. The places I particularly wished to see on Khadir Island were Amrapur in the east and Dholovira in the west, which from the map appear to be well situated for intercepting migratory birds.

Fresh water is extremely scarce after the winter season, and with the onset of the hot weather it is unobtainable except in a few spots where there are scanty natural springs, or *viris* (deep-shafted wells). The Banni area north of Bhuj though deficient in water is good grazing country for cattle after a normal monsoon. Homesteads of *maldharis* (property owners) possessing large numbers of excellent milch cattle are dotted about the area, concentrated in small groups where water is available. As the season advances and the water dries up, these herdsmen move on to other spots. The bird life for miles around concentrates about the wells and water-holes to drink, and at the time of my visit in April the early morning up to forenoon and then from about 4 o'clock onwards was the best time for watching birds at these watering places. To water the cattle the herdsmen draw from the deep wells and fill up shallow troughs prepared near by, and it is at these troughs that all the birds gather.

In selecting possible sites for camps, water was the foremost consideration since it would be impossible to keep a camp supplied from any distance. Population is sparse and daily labourers difficult to hire, and no facilities for the transport of water are available. In the neighbourhood of the wells and natural springs there is usually fairly luxuriant vegetation, chiefly bushes and shrubs of *Salvadora persica* and *oleoides*, *Prosopis spicigera*, *Capparis aphylla*, and such other semi-desert species. The growth was of a nature that would permit the effective use of mist nets.

The shade temperatures during the week I was in Kutch ranged from 82° F. minimum after midnight to 108° F. maximum in the day. Out in the sun it was far from pleasant, and the scorching wind which blew in a gale over the sandy wastes all through the day, particularly in the Banni, did not improve matters.

Although the greater part of the spring migration in Kutch was over by the time of my visit (first half of April), the following migrants were still present and were noted in varying numbers:

Circus aeruginosus, Tringa nebularia, T. totanus, T. ochropus, T. hypoleucos, T. glareola, Charadrius dubius, Numenius arquata, Anas clypeata, A. querquedula, Gelochelidon nilotica, Sylvia curruca, Hippolais caligata, Acrocephalus agricola, Motacilla f. melanogrisea, Upupa epops, Anthus campestris (?), *Hirundo rustica, Emberiza melanocephala, E. buchanani, Sturnus roseus.*

The last two species were in the greatest numbers. Rosy Pastors in perfect summer plumage were feeding everywhere on *Salvadora* berries now ripening profusely. A succession of flocks was observed at Rapar on 10th and 11th April, flying purposefully due north at sunset, obviously on migration.

Several places appeared suitable for netting camps : Wâd Wāli Wâi (Well of the Banyan), Nâd Vīri, Gândi, Nera Wāli Sāran (ill-drained ground ; spring?, bog?), Nīr, Kuār Bēt, Luna, Lakhpat, Fatehgadh, Bela Island, Bela, Jatawala, Bālāsar, and Desalpur. Of all these Kuār Bēt on the border of the Rann, besides being a delightful place to camp in, appeared to have great possibilities for trapping birds in both the spring and the autumn migrations. Possibly northern Saurashtra, along the Gulf of Kutch and the Little Rann, would be an equally suitable area and well worth investigation when the Kutch project was being expanded. It certainly seemed to be more accessible at all seasons than the Great Rann, and to present fewer problems of transport.

Another place that would need proper investigation was Suigam, north Gujarat, at the NE. corner of the Little Rann, which also seemed

View across Rann to Pachham "Island" from near Kuar Bet.

Mist net set along margin of field of bajri

(*Photos : Harold Trapido*)

Removing bird from mist net

(*Photos : Harold Trapido*)

very advantageously situated in relation to the general trend of migration over western India.

Pilot Field Session: Kutch, 15 September to 1 October 1959

In order to test the practical potentialities of the project and to train our personnel in the use of Japanese mist nets and the various techniques involved, a pilot scheme was launched in September 1959 while the autumn (inward) migration was in progress.

This was financed out of the grant received by the Society from the Rockefeller Foundation, supplemented by a sum of $1000 from W.H.O. as a token of their active interest.

The basic field party of the Bombay Natural History Society comprised myself and three assistants P. W. Soman, P. B. Shekar, and Fernando. In addition there were usually 2 to 4 volunteers in camp, who underwent training and participated in the activities from 5 days to a week each. The participation of these volunteers in the training programme was taken as an implicit undertaking on their part to offer their services again in March the next year. The Society bore their living expenses and, in some cases, also the cost of their travel to Kutch and back by air or rail.

Thanks to the grant from W.H.O., we were able to defray the cost of a return air passage from Switzerland for Dr. Alfred Schifferli, who kindly accepted our invitation to visit Kutch for a few weeks to train our workers in the use of mist nets and other relevant techniques employed elsewhere, particularly at the Swiss migration study centre in Sempach (near Lucerne) of which he is the Director. Dr. Schifferli arrived on 12th September and was in the field with us till 2nd October. His help was invaluable, and the training our staff received from him has stood them in good stead for carrying out the work in March 1960 and later competently and with confidence.

Unfortunately, the monsoon that year was phenomenally heavy and long-drawn. The average annual rainfall in Kutch is 13-15 inches, and for a succession of years it was not unusual to have much less, giving rise to drought conditions. In 1959 the monsoon was quite unprecedented. By the beginning of September, Kutch had already received over 50 inches of rain, including one cloudburst in which 15 inches (*c.* 375 mm.) fell in 24 hours! It caused considerable damage to houses, livestock, and agriculture. Many areas of sandy

semi-desert were converted into vast lakes. Road embankments and bridges were washed away in places. The flooded country and the ill-drained loamy soil rendered traffic impossible, and parts of the district became completely isolated for weeks on end.

One of the worst to suffer in this way was Kuār Bēt. The rains continued ceaselessly, and it soon became clear that there was no hope of our being able to reach the place while the autumn migration lasted. We were thus driven to look for a more accessible alternative spot where the training of the men at least could be put through with whatever birds were available.

There is a preserve of stunted thorn forest abutting on cultivation (*Sorghum* and *Pennisetum*), about three miles south of Bhuj, which seemed to answer the requirements. It contained a good population of resident birds and looked as if it would prove attractive to in-coming migrants as well. It was decided to concentrate our attention on this area. The results justified our choice; between 15th September and 1st October over 1750 birds were caught in the mist nets and ringed. They belonged to 56 forms, of which 27 were migrants and the rest endemic. The birds were banded with aluminium rings of three sizes A, B, and C bearing the legend 'INFORM BOMBAY NAT. HIST. SOCIETY' and 'No. . . . .' They were identified, measured, weighed, ringed, registered, and examined for ectoparasites before being released.

The Virus Research Centre, Poona, who were authorised by the Indian Council of Medical Research to co-operate with the Bombay Natural History Society in the project, sent two technicians. Dr. Harold Trapido, Asst. Director of the V.R.C., visited the camp for 2 or 3 days and laid down the procedure for his men. They remained with the field party throughout the work in order to collect ticks from the captured birds. Over 1700 birds were examined by them.

Positive as well as negative results were recorded. Ticks were found on 6 individuals of the following: *Pycnonotus cafer, Passer domesticus, Streptopelia senegalensis, Hirundo daurica, Emberiza melanocephala, Emberiza buchanani.* Of these species the last two are migratory and the other four are endemic in Kutch.

It became obvious that the most important bottleneck in any field activities that we undertook in Kutch would be motor transport. No vehicles are available in Bhuj for reasonable hire and, owing to the remote and rugged nature of the place where the spring migration work was planned (Kuār Bēt), it was essential to have adequate trans-

port arrangements which would guarantee free movement and independence from the vagaries of rapacious hirers and dilapidated vehicles. The Government jeeps and trucks upon which we had counted had all to be diverted to flood relief work, and the transport problem would have been crippling but for the helpful co-operation of the Maharajkumars Shri Fatehsinhji and Shri Himmatsinhji who very kindly placed their jeeps at the disposal of the party.

A list of the birds handled during our September field work is given in Table I. Migrant species are marked (M) and those from which ticks were obtained with an asterisk.

TABLE I

List of Birds Netted and Ringed: Kutch, 15 Sept. to 1 Oct. 1959.

Parus nuchalis	2	*Carpodacus erythrinus* (M)	13
Turdoides caudatus	55	*Passer domesticus**	185
Aegithina nigrolutea	8	*Petronia xanthocollis*	207
*Pycnonotus cafer**	231	*Emberiza melanocephala* (M)*	249
———— *leucogenys leucotis*	56	———— *buchanani* (M)*	12
Saxicola caprata (M)	2	*Hirundo daurica**	14
Oenanthe picata (M)	3	*Motacilla flava* (M)	1
Phoenicurus ochruros (M)	1	———— *alba* (M)	1
Erithacus svecicus (M)	2	*Anthus trivialis* (M)	1
Hippolais caligata (M)	30	*Mirafra erythroptera*	1
Saxicoloides fulicata	19	*Eremopteryx grisea*	13
Muscicapa striata (M)	10	*Nectarinia asiatica*	21
Lanius vittatus	1	*Dendrocopos mahrattensis*	1
——*collurio phoenicuroides* (M)	8	*Jynx torquilla* (M)	16
Tephrodornis pondicerianus	4	*Clamator jacobinus* (M)	8
Acrocephalus stentoreus (M)	7	*Eudynamys scolopacea*	1
———— *dumetorum* (M)	77	*Psittacula krameri*	2
———— *agricola* (M)	1	*Coracias garrulus* (M)	1
Orthotomus sutorius	3	*Merops orientalis*	6
Phragamaticola aēdon (M)	1	*Upupa epops* (M)	22
Sylvia communis (M)	41	*Streptopelia senegalensis**	63
—— *hortensis* (M)	2	———— *tranquebarica*	19
—— *curruca* (M)	6	———— *decaocto*	6
Prinia sylvatica	8	*Coturnix coturnix* (M)	3
——— *subflava inornata*	5	———— *coromandelica*	2
Sturnus roseus (M)	14	*Francolinus pondicerianus*	1
Acridotheres tristis	1	*Tringa ochropus* (M)	1
Ploceus philippinus	207		
Lonchura malabarica	75		

Total number of birds netted and ringed (excluding the 297 recaptured during the 17 days of field work) 1751

Incidentally the netting added three species to the Kutch list: the Grasshopper Warbler (*Locustella naevia*), the Black-

throated Weaver (*Ploceus benghalensis*), and the Thickbilled Warbler (*Phragamaticola aëdon*), the last being new for Saurashtra and Gujarat as well[1]. This bird was a surprise, since it is known only as an eastern species breeding in Siberia, Burma, Thailand, and south China, wintering chiefly in Assam and East Bengal, Bhutan, etc. It has been recorded also from Mysore and Kerala in winter. The Grasshopper Warbler and the Blackthroated Weaver Bird do not figure in the list because only one bird of each species was caught and it was kept as a specimen for the Society's collection. Two Thickbilled Warblers were caught of which one was kept as a specimen.

Spring Field Session: Kutch, 10 to 28 March 1960

The venue selected was Kuār Bēt which had stood first in my order of preference (see above). Several of the other likely places, e.g. Nâd Vīri and Nīr, were inaccessible for wheeled transport due to the Rann still being wet or flooded after the previous year's exceptionally heavy and prolonged monsoon.

Kuār Bēt is a flat, rocky and sandy, grass- and scrub-covered islet (directly opposite Kotda Police Outpost to the north). It is separated from the Pachham mainland by an arm of the Great Rann about a mile wide, and forms one of the most northerly points of Kutch district. There is a shallow depression in the middle of the islet which becomes a *jheel* during the monsoon and holds water till about January. The only 'fresh' water on the islet, such as it is, is provided by a well in the bed of this *jheel*. This well harboured a dense population of frogs (*Rana cyanophlyctis*) and was the only source of 'fresh' water on Kuār Bēt. Its water, analysed by the Public Health Laboratory, Bhuj, gave a pH value of 7.5 with a Permanent Hardness (as $CaCo_3$) of 100.4 and Temporary Hardness of 24.4. It was not potable, and drinking water for the camp had to be transported in drums by motor truck daily from the mainland, from a well called Wâd Wali Wâi some 6 miles distant. Adjoining the Kuār Bēt well is a mud-built trough for watering cattle and camels, to which all the birds for miles around repair to drink. The *jheel* bed is thickly covered with rank grass (Cyperaceae). This was still fresh and green in March and held numbers of Streaked Fantail Warblers (*Cisticola juncidis*) and a few Grasshopper Warblers

[1] See Sâlim Ali (1960): *J. Bombay nat. Hist. Soc.* **56**: 635.

A Whitethroat in the mist net

Placing the ring

(*Photos : Harold Trapido*)

Weighing bird in plastic bag and recording data

Ringing equipment

(Photos : Harold Trapido)

(*Locustella naevia*). The surroundings are well wooded with shrubs and moderate-sized trees of Babul (*Acacia arabica*), Kandi (*Prosopis spicigera*), *Acacia senegal*, *Capparis aphylla*, *Salvadora persica* and *S. oleoides*, *Zizyphus jujuba*, and other species. *Capparis* and *Salvadora* are the commonest bushes on the rest of the island, and patches of ground here and there are covered with jhil (*Chenopodium album* ?) a foot to 3 ft. high. Among the less pleasant features of Kuār Bēt was the extraordinary abundance of the Phoorsa or Saw-scaled Viper (*Echis carinata*) and scorpions on the island. In retrospect, it seems little short of a miracle that, in spite of narrow escapes almost every day and night, such a large party should have escaped without casualty.

In the advance party I was accompanied by Mr. D. J. Panday, Mr. Loke Wan Tho, and Mr. Charles Ho. We arrived in Bhuj by air from Bombay on 1 March in order to make arrangements for establishing camp on Kuār Bēt. Tents, camp furniture, and other requisites were hired locally from the Public Works Department of Gujarat, and efficient arrangements for transport of the equipment and extra personnel were made by the Department of Public Health of Gujarat. The main party consisting of 14 persons arrived by rail and air on 8 March. It included 4 technicians of the Virus Research Centre, 4 field assistants from the Bombay Natural History Society and 6 amateur ornithologists as voluntary helpers.

The question of local mobility for the field party was satisfactorily solved, thanks to our Vice-Patron Mr. Loke Wan Tho, who generously placed a station wagon at the disposal of the Society, and the Tata Locomotive & Engineering Co. Ltd. who loaned to us one of their Mercedes-Benz multi-purpose vehicles ('Unimog'). These two vehicles, together with a third 4-wheel-drive station wagon from the Virus Research Centre, proved invaluable for the unhampered movement of personnel, and of necessities such as food supplies and drinking water.

The field work started on 10 March with an average of some 20 nets, several of them consisting of more than one unit (one of 10), deployed over an area of about 1 square mile surrounding the *jheel* bed.

During the first week of our activities, 10-18 March, *Capparis aphylla* was in profuse blossom all over the island. The attractive salmon-pink flowers of this shrub contain a copious supply of sugary nectar which seems to serve as both food and drink to birds of many species and is eagerly sought by them. All the visitors get their forehead feathers thickly coated with pollen, and they doubtless play an im-

portant part in cross-pollinating the flowers. The birds invariably in attendance on these flowers were babblers (*Turdoides caudatus*) and bulbuls (*Pycnonotus leucogenys leucotis*) among the resident birds, and Rosy Pastors (*Sturnus roseus*), Orphean Warblers (*Sylvia hortensis jerdoni*), Lesser Whitethroats (*Sylvia curruca blythi*), and Tree Warblers (*Hippolais caligata*) among the migrants. Nets placed near flowering *Capparis* bushes took all these species.

Immediately encircling the dry lake bed, on the edge of which our camp was pitched, was a fairly dense green belt of moderate-sized trees and shrubs frequented by warblers and other small birds, both migratory and resident. This wooded belt and the flowering *Capparis* bushes beyond formed the principal features which dictated the placement of the nets, and on the whole yielded fairly satisfactory results. During the period of operation, 10-28 March, the total number of birds ringed was 1001. In addition to these there were 188 recaptures, particularly of the resident babblers and bulbuls, while a great many others (particularly babblers) captured in the nets and found positive for ticks were handed over to the virus technicians directly, without registering or ringing, as they were required to be killed for detailed examination.

In all 39 species of birds were captured and ringed, of which 21 species (or 54%) were migratory. Of the total number of individuals, 322 (or 32.2%) were migratory and the rest resident. The migratory species ringed are listed in the table at the end of this paper.

Unfortunately weather conditions after 18 March became freakish and abnormal, and produced a marked set-back in the flow of migration. While our two best days were 17 and 18 March with 109 and 106 birds respectively (excluding recaptures), they were abruptly followed by one of the worst. On the 19th only 21 birds were ringed. A heavy gale had sprung up during the night of the 18th which continued with unabated intensity all the next day. The windy season in the Rann of Kutch area normally commences only in the first or second week of April. The abnormality of weather was further emphasized by the unseasonable rain which fell on Kuār Bēt on 10 and 11 March. In some portions of Kutch, notably in the Banni a little north of Bhuj, the downpour was so heavy and continuous that the countryside was turned into a quagmire, disrupting motor traffic for over a week. This was followed by occasional dust storms and an unprecedented drop in the temperature, which touched 40° F. during the night of 21 March and 48° F. at 7 p.m. on the 22nd,

and kept in that neighbourhood for two more days. Completely unprepared for near-freezing temperatures so late on the season, the party spent some memorably uncomfortable nights.

Reports from bird watchers in other parts of Kutch and in Saurashtra confirmed that, presumably due to the exceptionally heavy and prolonged SW. monsoon of 1959 and the continuance of abnormally cool weather into March 1960, the spring migration was greatly retarded, the species and quantities of migratory birds commonly seen at this time of year not yet having appeared by the end of that month. Whether they would come along at some later date, in April, remained to be seen though, as far as Kuār Bēt was concerned, there was little hope of ascertaining this on account of the remoteness of the locality and difficulty of access to it.

We found the best conditions for success with mist nets to be when the sky is cloudy and overcast, and cool at midday with the air still or a light breeze blowing, as on our two best days. Mist nets proved completely useless under windy conditions. In addition to the fact that high wind directly inhibits local bird activity, mist nets have a tendency to bunch in folds at one end in a cross-wind, rendering the net so taut over the rest of its length that even when a bird flies into it, it bounces back and is usually able to escape. When the wind is head-on to the net, the net billows out so much to the lee that it becomes equally ineffective in 'bagging' the bird.

Altogether the field work on Kuār Bēt in March proved less successful than was anticipated. To what extent abnormal weather was accountable for this disappointment it is difficult to assess. It might be worthwhile to try here once again during the autumn migration if the approach through the Rann at that season permits. It struck me, however, that perhaps a more rewarding course in future work would be not to be encumbered with a large central camp in any one place, but to split up into small independent units each consisting of a couple of ornithologists with local helpers and a couple of virus technicians with the necessary equipment for camping and working at a number of selected points over a wider area in northern Kutch and Saurashtra. In this way it may be easier to hit upon the most suitable places for intercepting migrants.

The netting on Kuār Bēt in March added two more species to the Kutch bird list, namely the Blackcrowned Finch-Lark [*Eremopterix nigriceps affinis* (Blyth)] previously recorded within Indian limits only from Rajasthan and eastern Punjab, and the Grey Hypocolius

(*Hypocolius ampelinus*) a Persian and Iraqi bird of which only two specimens have so far been taken in India as rare vagrants.[1]

In addition to the above, the Eastern Rosy Pelican (*Pelecanus onocrotalus roseus*) was discovered, for the first time, to nest in India. The nests were found among worn-down old flamingo nests on the periphery of the occupied Flamingo City in the Great Rann. These pelicans were heretofore only known as winter visitors, and the large colony of an estimated 3000-4000 adults in early summer and hundreds of nests with eggs or young are of particular interest. It is reported by the flamingo warden that he observed these birds nesting here for the first time only in 1959, so they would now appear to be establishing themselves as a breeding species. A more detailed note has appeared in the *Journal*.[2]

A further point of interest, and a somewhat intriguing one, was the netting, on 10 March of one more example of the Thickbilled Warbler, *Phragamaticola aëdon*. The unprecedented and unexpected meeting with this species in Kutch the previous September (recorded above) had raised speculation as to whether the examples then captured were merely vagrants, or whether the species is possibly a regular winter visitor (or autumn passage migrant) but overlooked in the past. The capture of a third specimen in March poses the question whether the bird had spent the winter in Kutch, or was now on northward passage to its breeding grounds from its known winter quarters in SW. or eastern India—whether indeed the hitherto recorded status of this warbler needs amending.[3]

Autumn Field Session: Saurashtra, 8 to 30 September 1960

Owing to the difficulties of getting the transport vehicles across the Little Rann from Saurashtra into Kutch and also of reaching the outlying areas bordering the Great Rann so soon after the monsoon, field work for the autumn migration was confined to the Saurashtra peninsula in Gujarat. This lies between 21° N. lat. and the Tropic of Cancer, and 69° and 72° 30′ E. long., therefore well athwart the NW. route of bird migration into India.

Two field camps were established, one on Jalandar (or Jhillander) Bēt, an islet separated from the border village of Jhinjhuvada by a mile-wide arm of the Little Rann, the other at Hingolgadh the private estate of the Raja Saheb of Jasdan, about 12 miles from the capital of that quondam Indian State.

---

[1] P. B. Shekar (1960): *J. Bombay nat. Hist. Soc.* 57: 224-5.
[2] Sálim Ali (1960): *J. Bombay nat. Hist. Soc.* 57: 412-5.
[3] Since then it has also been taken in Rajasthan (see p. 123).

Jalandar Bēt is a flat, sandy islet, covered with semi-desert scrub which in some places is quite dense. This is particularly so in and along the dry, often steeply eroded, water-courses with which the islet is scoured. The vegetation is of a xerophytic character and the over-all ecology of the place is reminiscent of Kuār Bēt in Kutch *Prosopis spicigera, Capparis aphylla, Salvadora persica,* and *S. oleoides,* stunted trees and bushes, are common and abundant, and when in flower and fruit in spring must constitute a great attraction for many species of passerine birds — warblers, Rosy Pastors, and others.

In recent years *Prosopis juliflora* has been widely planted by the Forest Department in the barren salt-lands bordering the Rann as part of their desert reclamation programme. It has taken well, and now forms flourishing and extensive thickets here and there. Curiously enough, in spite of the shade it provides in a land where any shade is welcome and, *contra* its congener *P. spicigera,* this species is studiously avoided by birds of all kinds.

Hingolgadh is situated more inland, in central Saurashtra. It is an undulating area of rocky and stony thorn scrub, which has been closed to grazing, hacking, and felling for many years and, under strict protection, has now become an island, or oasis, of fairly dense thorny vegetation set in the midst of the extensive champaign under cereal and groundnut cultivation. The activities at the Hingolgadh camp were under the efficient and enthusiastic direction of Yuvraj Shri Shivrajkumar of Jasdan.

Each of the two camps was manned by a more or less equal basic complement of workers: two members of the field staff of the Bombay Natural History Society, and three technicians of the Virus Research Centre, Poona. These teams were assisted at either camp by two post-graduate Avian Biology students of the Baroda University. Dr. R. M. Naik of the Department of Zoology, Baroda University, who received his training at our Kuār Bēt camp earlier in the year, was in charge of the Jalandar Bēt camp. It was refreshing to find such flexibility and useful co-operation from a university department which, in India, are normally so rigidly conventional and hide-bound. It is to be hoped that more universities and science-teaching institutions will realize the value of the facilities these field camps afford and will second their biology teachers as well as senior students to participate in the activities of the Bombay Natural History Society. Participation in such outdoor scientific activities can prove of very great mutual advantage. The Society's ringing work with migratory birds in India will begin to

pay dividends only when it can be expanded to cover all parts of the country. This cannot be achieved without voluntary effort and the co-operation of universities in encouraging their post-graduate biology students to take part in our field work while keeping their academic terms.

The combined teams of the Bombay Natural History Society and the Virus Research Centre, Poona, arrived at their respective posts on 7 September, and field operations commenced on the morning of the 8th. The Jalandar camp remained in operation till 25 September (18 days), and Hingolgadh up to 28 September (21 days).

The failure of the monsoon in the Jalandar area caused abnormally high day temperatures in September, the daily maximum ranging mostly between 95° and 105° F. in the shade, with a relative humidity of between 64% and 79%. The sun temperatures at midday were so high that many birds died in the nets if left exposed even for a few minutes. During the last few days this necessitated our putting the nets out of action after 11 a.m. and opening them again only when it became relatively cooler in the afternoon—a circumstance which naturally reflected adversely on our daily catches. The position at Hingolgadh was somewhat better, but there also a certain amount of mortality among the netted birds dictated similar precautions latterly.

The destruction of our nets by the large and ever increasing numbers of cattle, driven in for pasture to Jalandar from the surrounding drought-ridden villages, swelled to such an extent that we were compelled to abandon the work on 25 September, 4 days before schedule. The results of the field work, in so far as the total number of ringed birds is concerned, are comparable in both camps but, as will be seen from Table II below, the composition of the catches in the two areas was strikingly different. During the 18 days of rather fitful operation on Jalandar Bēt 1008 birds were ringed. They represented 46 forms, of which migrants accounted for 22. The most abundant migratory species here proved to be *Sylvia hortensis jerdoni* (94), followed by *Sylvia curruca blythi* (58), *Hippolais caligata rama* (47), *Sylvia communis icterops* (41), *Jynx torquilla* ssp. (16), and *Erythropygia galactotes familiaris* (13). During the 20 working days at Hingolgadh camp (3 more than at Jalandar) in all 1232 birds representing 72 forms were ringed. Of these over 50% were migratory. The most plentiful migrant species in the Hingolgadh area during this period was *Sylvia communis icterops* (256 examples), which ranked 4th

in order at Jalandar. *Sylvia hortensis jerdoni*, which was No. 1 at Jalandar, came next. At Hingolgadh, Rosy Pastors (*Sturnus roseus*) were present in enormous swarms (as they were also at Jhinjhuvada, but not so many at Jalandar) although only 58 were taken in the nets. These birds, which had already arrived in large numbers by early August, continued in abundance in the 2 localities, and more or less throughout Saurashtra, during September. They were now feeding chiefly on the ground on grasshopper nymphs, and on the ripening jowar and bajra (cereal) standing crops. They roosted in enormous swarms in the dense grove of trees surrounding the Rest House at Jhinjhuvada, where large flocks converged from all directions at sunset. There was a large roost also on the edge of the netting area at Hingolgadh.

Hingolgadh had 10 Kashmir Rollers (*Coracias garrula semenowi*) while Jalandar had none, only 2 examples being noted during the entire period and that within the last week; whereas against the 13 Greybacked Warblers (*Erythropygia galactotes familiaris*) ringed at Jalandar none was caught at Hingolgadh and only one observed in the area during the entire period. The difference in the composition of the resident bird population is even more striking, but this may be accounted for largely by the difference in ecological conditions. For the migrants, most of which would be merely passing through at both places, the composition of the catches respectively provides the first positive datum suggestive of the pattern on which bird migration takes place in this part of the country, and pinpoints the need for further analysis and investigation. The captures at the two field stations, operating simultaneously and no more than about 50 miles apart as the crow flies, afford interesting comparison of the differential movements of various species during migration, but many more data will be needed before the position can be understood. Additional interest is lent to this problem by the results of 4 days' subsequent netting (on 10-11 and 20-21 October) by Yuvraj Shivrajkumar in the Hingolgadh neighbourhood, about 3 miles distant from the September area. With 4 helpers, using on an average 10 nets, his catches amounted to 45, 96, 54, and 149 birds, or a total of 344. They included 263 migrants of 18 species, of which the most prominent were: *Calandrella cinerea* (120), *Emberiza buchanani* (79), *Upupa epops* (12), *Sylvia curruca* (11), *Hippolais caligata* (11).

From the point of view of arthropod-borne viruses, a very striking contrast in tick infestation is presented in the two areas.

While the percentage of positive birds at Jalandar Bēt (semi-desert country) was comparatively insignificant, at Hingolgadh (fairly thick thorn scrub forest) it was over 16%. The significance and implications of this differential tick infestation will be better understood when the material has been identified and ecologically studied. This, as well as the results of the bleeding of several species of birds undertaken by their technicians, will be reported on separately by the Virus Research Centre.

Of the 980 migrants examined at the 2 camps 86 individuals (8.7%) bore ticks, while 155 (14.5%) of the 1062 residents were so infected. In the latter, infestation among the ground-dwelling partridges and quails was as high as 85% (22 examined) and 61% in the Indian robins (108 examined).

Our greatest handicap today is the lack of competent field ornithologists and trained field personnel. These camps, which are in the nature of continuing seminars, provide admirable opportunities not only for learning bird identification and migration study techniques, but also for co-operative living and team work by persons of kindred scientific interests, and for stimulating informal discussions on a variety of ornithological and technical problems. The Bombay Natural History Society invites university biology teachers and students, and others seriously interested in the problems of Indian migration and in the role of birds as disseminators of arthropod-borne viruses, to take advantage of the opportunities afforded by its spring and autumn field camps, so that they may qualify themselves to conduct similar work in other parts of the country independently, and contribute towards making up some of the leeway from which scientific ornithology suffers in India.

Visitors: Drs. Harold Trapido and Jorge Boshell, of the Virus Research Centre, Poona, spent several days at each camp sharing in, and directing, the activities of their entomologists and the technicians. In addition, the camps were visited for varying periods by a number of persons, either to assist in the work or for training and experience. Among these were Messrs Zafar Futehally, Dinshaw and Jamshed Panday (Bombay), R. S. Dharmakumarsinhji (Bhavnagar), K. S. Lavkumar (Rajkot), Prof. J. P. Joshua and Mr. Gift Siromoney (Madras).

During the field work on Kuār Bēt (Kutch) in March 1960, blood smears from about 60 netted birds were taken at the request of Dr. Marshall Laird of McGill University, Canada, who is interested in studying the zoogeographical status of avian haematozoa from our

region, particularly the species of *Plasmodium*. A detailed report has still to come, but he writes that a preliminary glance through the material has shown several of them with Haemoproteus infections (i.e. mosquito-transmitted bird malaria), and a number of *Turdoides c. caudatus* to be harbouring *Atoxoplasma*. A further collection of 62 smears was made for Dr. Laird from birds netted on Jalandar Bēt during September.

Spring Field Session: Kutch, 9 to 26 March 1961

Following the deficient SW. monsoon of 1960, the greater part of Kutch was officially declared a scarcity area. Many of the smaller bunded irrigation reservoirs dried up by January, and it was only the unexpected 3 inches or so of unseasonable rain that fell in late February that ameliorated the situation somewhat, and averted drought conditions.

The northernmost areas, along the edge of the Great Rann, were amongst the most seriously affected. The only source of water on Kuār Bēt, where the spring migration field camp had been operated in 1960, was almost dry by early March, and in contrast to the lush conditions of vegetation in 1960, the island presented a desiccated and forbidding appearance. The few places in the northern areas where any water was available were overrun by village cattle driven in from scarcity areas far around, and past experience had amply demonstrated that cattle and mist nets cannot co-exist!

It was a problem to find a place with the required conditions for netting, yet free from cattle. Two promising sites were finally selected, (1) at Chaduva about 14 miles WSW. of Bhuj, and (2) in Wanothi Rakhal (or forest preserve) near Assambia village, *c.* 9 miles N. of Mandvi.

1. *Chaduva* (*c.* 23° 15′ N. × 69° 40′ E.): This is the private estate of H. H. the Maharao of Kutch. It contains a well-watered, well-wooded orchard of mango, guava, mulberry, and other fruit trees. This garden is situated immediately below the dam which impounds the extensive Prāgsar tank (or reservoir). A seepage nala (or stream) trickles through the garden, the bed of which for about 200 yards or more is densely overgrown with coarse reeds (*Saccharum* ?) 10 to 12 ft. high. Bordering this garden on one side is a stretch of cotton fields, lying fallow at this season. The surrounding hummocky country which forms the catchment area of the two large bunded

(dammed) tanks Prāgsar and Phārsar is stony and sparsely scrubbed with the normal semi-desert type of vegetation characteristic of Kutch.

The Chaduva garden is the nightly roost of enormous hordes of House Crows (*Corvus splendens*), estimated as *c.* 10,000, which gather from before sunset and into dusk from long distances around to sleep in the large leafy trees, whereas the smaller mango grafts and guava trees together with the adjoining reed-bed are patronized by Common Mynas (*Acridotheres tristis*), estimated as 5000+, and Rosy Pastors (*Sturnus roseus*), estimated as 2000+, together with hundreds of bulbuls, both *Pycnonotus cafer* and *P. leucogenys leucotis*, Bank Mynas (*A. ginginianus*), and countless weaver birds (*Ploceus philippinus*).

Besides myself, the personnel here consisted of 1 member of the Society's field staff, a personal attendant trained for the work, Mr. P. V. Rajamannar of the Delhi University Zoology Department, and Rev. Axel Krebs, a Danish Missionary from Madras State. A second member of the Society's staff, D. Mathew, and V. C. Ambedkar, a post-graduate Field Ornithology student of the Bombay University, joined the party a few days before the operations were wound up. Two technicians of the Virus Research Centre looked after tick collection from the birds.

2. *Wanothi Rakhal* (*c.* 22° 50′ N. × 69° 30′ E.): This is an area of thorn forest preserved by the Forest Department principally for cattle fodder and fuel (firewood). The vegetation is composed largely of species such as *Acacia arabica, A. senegal, Prosopis spicigera,* and the others usual to a semi-desert biotope. The Mandvi District of southern Kutch, within which the reserve is located, is rather fertile, well-watered and well cultivated, and dotted about with green and flourishing *wādis* (market gardens), and lush lucerne fields irrigated from ring wells and dammed reservoirs. There are several rivers in this section with sandy beds which still ran trickles of water by the end of March, with puddles and squelchy patches here and there covered with dense reedbeds, large and small, which afforded community roosts to wagtails, swallows, and weaver birds.

The camp itself was located just below, and adjacent to, the dam of the Assambia tank, at the head of an effluent feeder canal. The seepage from the dam formed several stagnant marshy pools, overgrown along their edges by bulrushes (*Typha*), and these marshes and their surroundings provided attraction for wagtails, warblers, swallows, and other species, both resident and migratory. The Wanothi camp was under the direction of Yuvraj Shivrajkumar of Jasdan assisted

by P. W. Soman, M. Pereira and P. Swami of the Society's staff, and A. R. K. Das, post-graduate Avian Biology student of Baroda University. Unfortunately, being pre-occupied with other commitments elsewhere, no entomologists or technicians could be spared by the Virus Research Centre for this camp, hence some valuable opportunities for tick collection from migrant birds such as swallows and wagtails were missed.

On the whole it seemed that bird movement was tardy during the period of operation of the camps, and that possibly migration was delayed. This impression was partly confirmed by reports coming in from Saurashtra as well. However, up to a point it may also be that the netting sites themselves were less favourable as compared with the more forward areas in northern Kutch along the borders of the Great Rann. When motoring back through eastern Kutch and Saurashtra at the end of March, Blackheaded Buntings (*Emberiza melanocephala*) were observed in large numbers which looked as if they were working their way westward and northward. Rosy Pastors were also far more abundant and widespread in Saurashtra and Gujarat at that period than they were in Kutch.

During this spring session one more species was added to the Kutch list, namely the Moustached Sedge Warbler (*Lusciniola melanopogon*)[1], of which six examples were taken in the nets at Wanothi. This warbler is not uncommon in winter in West Pakistan, but has only been recorded exceptionally in India as far south as Madhya Pradesh, and also in Saurashtra. The number caught suggests that it may perhaps be less rare than supposed.

An interesting experience, worth recording, was the re-capture of two ringed bulbuls (1 *Pycnonotus cafer*, 1 *P. leucogenys leucotis*) during a morning's snap netting at Changalra (Bhuj neighbourhood) in the identical half-mile square that was worked during the first session of this series 18 months earlier—in September 1959. Both the birds were registered as adult at that time.

During this latest session our attention was increasingly shifted to the overriding advantage of netting migratory birds like the Rosy Pastor and wagtails and swallows at their communal roosts. The possibility of bulk capture of these species—of significance from the tick infestation and virus dissemination point of view—was limelighted by the experience at Wanothi where, within an hour's netting at a wagtail roost at sunset, over 170 birds were caught, and at a swallow roost near-by over 50. It appeared that our most fruitful

[1] *J. Bombay nat. Hist. Soc.* 58 : 513.

course for future activities would be to search out suitable roosts in marshy reedbeds etc. and concentrate all effort on these. However, our experience with Rosy Pastors, roosting in their close-packed tantalising thousands amongst similar reedbeds and shrubbery, proved thoroughly futile and disappointing! These birds are far too cunning for ordinary mist netting, and seem to possess an uncanny instinct for avoiding the nets. Perhaps our most rewarding course with them would be to employ professional bird catchers with their special techniques. The Rosy Pastor seems a particularly desirable subject for attention, both from the migration study and from the virus dissemination points of view. (A significant proportion of those examined previously were found positive for ticks.) This is a fairly large, conspicuous, and widely distributed species in its Indian winter quarters. It comes in enormous swarms, and lives, feeds, moves about, and roosts in vast congregations. It is destructive to cereal crops, and is itself relished as an article of food and, therefore, largely shot and netted everywhere as well as all along its migration routes, thus increasing the chances of ring recoveries.

A total of 2192 birds representing 69 species were captured and ringed at the two camps. They included 641 migrants (*c.* 30% of the total) of which 578 (*c.* 90%) were taken at Wanothi including 276 Yellow Wagtails (*Motacilla flava melanogrisea* and other races), 159 White Wagtails (*M. alba* mostly *dukhunensis*), and 32 Yellow-headed Wagtails (*M. citreola*), and 73 Common Swallows (*Hirundo rustica*).

Among the common resident birds in the present series, most frequently and consistently found with ticks attached were the Common Babbler (*Turdoides c. caudatus*), the Indian Robin (*Saxicoloides fulicata cambaiensis*), and the Weaver Bird (*Ploceus p. philippinus*), in that order. Among the migrant species, although the samples examined were inadequate, a high frequency of tick infestation was indicated by the Bluethroat (*Erithacus svecicus* ssp. ?) and the Redstart [*Phoenicurus ochruros phoenicuroïdes* (?)].

In several instances it was noted that a bird, found negative for ticks when first ringed and released, had ticks attached to it when re-captured two, three, or more days later. This could be due either to the ticks having escaped detection on the first occasion, or to their being picked up during the interval.

The identification of the ticks in the present series awaits study in the Virus Research Centre laboratory at Poona. The majority of those taken during the spring of 1960 (on Kuār Bēt) have been reported as

Haemaphysalis (*intermedia* ?) with a small percentage of *Hyalomma* sp. As against this, the ticks collected from birds in Saurashtra during autumn 1960 (Jalandar Bēt and Hingolgadh) included, in addition to *Haemaphysalis* (*intermedia* ?) (the majority), a few larvae and nymphs provisionally identified as *Hyalomma* sp., *Amblyomma* sp., and 1 or 2 examples of *Rhipicephalus* sp.

The Hyalommas are described as ticks of relatively dry areas. This genus as well as the species *Haemaphysalis intermedia* are not known to occur in the epizootic region of the Kayasanur Forest Disease in Mysore etc., though another species of the latter genus, namely *Haemaphysalis spinigera*, is abundant there and the principal carrier of the Kayasanur Forest Disease virus.

Autumn Field Session: 11 to 30 September 1961

Heavy monsoon rendered work in Kutch impracticable for the purpose of transport and communication, and a search had to be made for alternate venues for the autumn camps.

A restricted area in the neighbourhood of Bhavnagar town was selected for one of the camps. A second camp was established at Bharatpur in eastern Rajasthan (about 160 km. south-west of Delhi), which some pilot mist netting in late spring had indicated as a promising venue for migratory wagtails, swallows, warblers, and other passerines.

1. Bhavnagar (*c.* 21° 45′ N. × 72° 15′ E.), 12 to 30 September 1961

The netting here was principally done in a fenced-in area of reserved thorn jungle and scrub of about 500 acres under the Forest Department, known as Victoria Park. The area is protected against lopping of trees and grazing and browsing by domestic animals. It used to be a model wild life sanctuary in miniature in former years, and still holds some nilgai and wild pig. The vegetation consists of moderate-sized trees and shrubs of *Acacia arabica*, *A. senegal*, *A. catechu*, *Prosopis spicigera*, with an intermingling of *Salvadora persica* and *S. oleoides*, and the recently introduced all-too-flourishing *Prosopis juliflora*. At the end of the monsoon, which was again much above the average here, the Park presented a luxuriant appearance, and being in the nature of an island of greenery on the edge of the town, surrounded by cultivation and open country, it seemed to offer attractive conditions for migratory passerines on

arrival. It had, in fact, been reported as a favourite halting place. The Park contains a low-lying basin of several acres, which becomes a lake during and after the monsoon and retains some water all the year round. Around its margins are beds of reeds and sedges suitable for reed warblers, and as night roosts for swallows and wagtails. In spite of these apparent advantages, the results of our 18 days' netting in the Park proved disappointing. Whether the second half of September is too early in the season for strong incoming migration (as we now suspect), or whether the vagaries of the monsoon were responsible for retarding it that year, or whether the choice of the venue itself was basically wrong, it is difficult to assess, but this much is certain that migration had apparently just commenced to trickle in by the end of September when the camp was being wound up. A total of 466 birds (58 species) was ringed in Bhavnagar, of which 90 (17 species) were migrant, i.e. about 19%.

In regard to tick collection, it is unfortunate that the Virus Research Centre were unable to render the necessary co-operation to our field teams this autumn as they had done on previous occasions. In the absence of special technicians to examine the birds, valuable opportunities were lost. The ornithological personnel in both camps, despite the voluntary help it periodically received from visiting bird students, was short-handed and otherwise pre-occupied, and often also grossly overworked. Some more satisfactory arrangement will need to be worked out for the future to ensure the fullest advantage being taken of the valuable opportunities afforded by these field sessions for studies of the role of birds in the dissemination of arthropod-borne viruses.

2. Bharatpur (27° 13′ N. × 77° 32′ E.), 11 to 30 September 1961

Mist netting here was done chiefly in and around the Forest Nursery situated within the Keoladeo Ghana Wild Life Sanctuary, and in the swampy fallow fields adjoining Jatoli village immediately outside. The higher ground in the village precincts was under maize, jowar, and bajra cultivation, most of which had suffered badly from the exceptionally heavy and late-continuing rains—already more than double the annual average—which had caused widespread floods and devastation in many parts of central and northern India. The Keoladeo Ghana, a natural depression some 7000 acres in extent densely covered with thorn jungle, is under the protection of the Forest Department. The vegetation consists largely of trees and shrubs of *Acacia arabica, Prosopis spicigera, Capparis horrida, Salvadora*

persica and *S. oleoides*, and *Zizyphus jujuba*, with a sprinkling of large and ancient trees of *Stephegyne parviflora*. Dense shrubbery of *Clerodendrum* (*phlomoides* ?) occurs outside the forested area. In a year of good monsoon (such as the present) a large portion of the Ghana forest becomes inundated and teems with fish brought down by the various rivers that contribute to its water supply. This remarkable abundance of food is the basis of the phenomenal concentrations of nesting storks, egrets, herons, cormorants, and other water birds, for which the Keoladeo Breeding-Waterbird Sanctuary has acquired fame within the country and abroad. The lake also affords winter refuge to countless migratory ducks and geese, and is reckoned as one of the finest duck-shooting *jheels* in India.

By April the greater part of the Ghana dries up, furnishing rich grazing to thousands of cattle from the town and surrounding villages. Little 'islands' of sedges and bulrushes then stand out here and there amidst swampy patches on its bed to serve as night roosts for wagtails, swallows, and reed warblers. It was the chance stumbling upon one such roost in May 1961, which yielded 370 birds (including 184 migrants) on five consecutive evenings' mist netting, that first gave a clue to the inherent potentialities of the Ghana for ringing passerine migrants and prompted its selection for the present field camp.

During the period between 10 and 30 September there was a great surfeit of flood waters everywhere and most of the reedbeds were submerged. No roosts of swallows or wagtails were discovered among them. Bird migration was on the whole distinctly tardy and, as in Saurashtra, it appeared that here also we were as yet too early for most species. But for a fortunate and fortuitous rush of Yellow Wagtail (*Motacilla flava*) migration, our results would have been no less disappointing than in Bhavnagar. Only small numbers of wagtails were observed on 10th September, yet three days later the marshy fallow fields were literally swarming with them—mostly the three subspecies *thunbergi*, *beema*, and *melanogrisea*. Their flocks in the air were reminiscent of major locust swarms. I cannot recall ever seeing such masses of wagtails together! Of the total number of 1122 birds caught and ringed in Bharatpur during the twenty days (see Table II) 681 were Yellow Wagtails. Since other migrant species were as yet in insignificant quantities only, it was decided to focus all our efforts on the wagtails alone. Owing to a continuous wind in the exposed fields, at least thrice as many birds bounced back and escaped from the nets before they could be removed, but even otherwise these would have represented merely a very small fraction

of the wagtails present in that area of a few hundred acres! Over and over again experience has proved mist nets to be almost completely ineffective on windy days, especially in the case of such light-weight birds as wagtails and warblers. As yet no remedy for this has been found.

Working under pressure, it was early realized that there was little point in ringing common resident birds such as bulbuls, babblers, and mynas. Whenever it was practicable to examine the captives for ticks this was done; but otherwise, in most cases, such birds were promptly set free. In this way possibly some 300 or more birds were released unringed. Therefore in Table II any comparison by proportion of the percentages of resident and migrant species would be irrelevant.

A proposed innovation referred to at p. 118 above was tried out during the present field session, namely the employing of professional netters in order to supplement our own catches by sizeable quantities of migratory birds such as ducks, Grey Quails, Rosy Pastors, and waders (in-coming Ruff & Reeve pass through Bharatpur in autumn in enormous numbers). Two sets of 2 men each were imported from Bareilly (a centre of the wild bird trade) claiming to be experts in the art. One set was assigned to Bhavnagar, the other to Bharatpur. In both cases the experience proved a dismal failure and the claims of the men to be exaggerated out of all recognition! It is true that September may have been too early, considering the abnormal weather conditions, for Grey Quail and Ruff & Reeve, but the trappers even failed to catch any Rosy Pastors at a populous roost in Bhavnagar, and only a very negligible quantity of some of the common resident birds! Moreover, most of their catching was done with bird lime, a method quite unsuited for birds intended for ringing and prompt release. Though the experiment proved disappointing and disproportionately costly, it is felt that it may be worth repeating under more favourable auspices.

Besides the birds caught in mist nets, 111 nestling water birds[1] were ringed in the Keoladeo Breeding-Waterbird Sanctuary. This was in continuation of previous ringing work in this heronry, in an attempt to study the post-breeding dispersal of its seasonal occupants, which obviously converge here from over a very extensive range. One of the nestling Openbill Storks (*Anastomus oscitans*) ringed in the sanctuary on an earlier occasion was recovered at a

[1] Chiefly Purple Heron (*Ardea purpurea manilensis*), and the White Egrets (*Egretta intermedia* and *E. g. garzetta*).

distance of over 500 miles a few months later—an unsuspected wandering. The vast concentrations of nestling waterbirds and their young at this unique heronry (chiefly the families Phalacrocoracidae, Ardeidae, Ciconiidae, and Threskiornithidae) would seem to offer unparalleled opportunities for serological studies connected with the problem of virus transmission through bird-biting mosquitoes and other arthropods.

An interesting addition to the Rajasthan bird list, and a significant extension of its known winter range in India, was provided by a single specimen of the Thickbilled Warbler (*Phragamaticola aëdon*) taken in the nets at Bharatpur on 15 September. This large warbler, which could easily be mistaken in the field (and no doubt often is) for the Great Reed Warbler (*Acrocephalus stentoreus*), breeds in the USSR from eastern Altai and Kemerovo to Manchuria, and in central Japan. It winters at low elevations in the eastern Himalayas and Assam, and mainly on the eastern side of the Indian peninsula; also in Kerala, Mysore, and southern Maharashtra. It will be recalled that in autumn 1959 it was obtained for the first time (see pp. 105, 106) as far north on the western side as Kutch.

TABLE II

Summarized statement of the 3366 Migratory Birds ringed in five ringing sessions, 1959-61

Species	Pilot Camp	Spring 1960	Autumn 1960	Spring 1961	Autumn 1961	Total
1. Sparrow-Hawk, *Accipiter nisus* ..	..	..	..	..	1	1
2. Pale Harrier, *Circus macrourus* ..	..	2	..	..	..	2
3. Kestrel, *Falco tinnunculus* ..	..	..	..	1	..	1
4. Common Quail, *Coturnix coturnix*	3	2	..	..	..	5
5. Green Sandpiper, *Tringa ochropus*	1	..	..	..	..	1
6. Wood Sandpiper, *Tringa glareola* ..	..	..	..	6	..	6
7. Fantail Snipe, *Capella gallinago* ..	..	..	..	1	..	1
8. Pied Crested Cuckoo, *Clamator jacobinus* ..	8	..	4	..	5	17
9. European Nightjar, *Caprimulgus europaeus unwini* ..	..	..	1	..	1	2
10. Bluecheeked Bee-eater, *Merops superciliosus* ..	..	..	..	..	2	2

Summarized statement of the 3366 Migratory Birds ringed in five ringing sessions, 1959-61 (*contd.*)

Species	Pilot Camp	Spring 1960	Autumn 1960	Spring 1961	Autumn 1961	Total
11. European Roller, *Coracias garrulus* ..	1	..	13	..	..	14
12. Hoopoe, *Upupa epops* ..	22	12	10	1	15	60
13. Wryneck, *Jynx torquilla* ..	16	14	33	3	30	96
14. Short-toed Lark, *Calandrella cinerea* ..	..	..	..	6	..	6
15. Swallow, *Hirundo rustica* ..	..	..	..	73	2	75
16. Redbacked Shrike, *Lanius collurio*	8	2	37	..	..	47
17. Golden Oriole, *Oriolus o. kundoo*	..	..	1	..	9	10
18. Grey or Ashy Drongo, *Dicrurus leucophaeus* ..	..	..	..	1	1	2
19. Rosy Pastor, *Sturnus roseus* ..	14	60	70	9	..	153
20. Spotted Flycatcher, *Muscicapa striata* ..	10	..	32	..	1	43
21. Redbreasted Flycatcher, *Muscicapa p. parva* ..	..	15	..	3	..	18
22. Paradise Flycatcher, *Terpsiphone paradisi* ..	..	..	2	..	4	6
23. Moustached Sedge Warbler, *Lusciniola melanopogon* ..	..	..	..	6	..	6
24. Grasshopper Warbler, *Locustella naevia straminea* ..	..	..	1	..	..	1
25. Thickbilled Warbler, *Phragamaticola aëdon* ..	1	1	..	..	1	3
26. Indian Great Reed Warbler, *Acrocephalus stentoreus* ..	7	18	..	2	..	27
27. Blyth's Reed Warbler, *Acrocephalus dumetorum* ..	77	23	48	4	38	190
28. Paddyfield Warbler, *Acrocephalus agricola* ..	1	..	..	8	..	9
29. Booted Warbler, *Hippolais caligata* ..	30	22	56	..	9	117
30. Whitethroat, *Sylvia communis* ..	41	..	305	..	4	350
31. Orphean Warbler, *Sylvia hortensis* ..	2	61	149	..	11	223
32. Lesser Whitethroat, *Sylvia curruca* ..	6	64	132	16	7	225

Summarized Statement of the 3366 Migratory Birds ringed in five ringing sessions, 1959-61 (*contd.*)

Species	Pilot Camp	Spring 1960	Autumn 1960	Spring 1961	Autumn 1961	Total
33. Hume's Lesser Whitethroat, *Sylvia althaea* ..	..	..	6	..	..	6
34. Brown Leaf Warbler, or Chiffchaff, *Phylloscopus collybita tristis* ..	..	3	..	14	..	17
35. Bright Green Leaf Warbler, *Phylloscopus nitidus* ..	..	..	1	..	1	2
36. Greybacked Warbler, *Erythropygia galactotes familiaris* ..	..	..	13	..	..	13
37. Bluethroat, *Erithacus svecicus* ..	2	4	..	8	8	22
38. Black Redstart, *Phoenicurus ochruros* ..	1	6	15	8	4	34
39. Stone Chat, *Saxicola torquata* ..	..	..	..	..	4	4
40. Pied Bush Chat, *Saxicola caprata*	2	..	2	..	2	6
41. Pied Chat, *Oenanthe picata* ..	3	..	1	..	..	4
42. Blue Rock Thrush, *Monticola solitarius pandoo* ..	..	..	..	..	1	1
43. Tree Pipit, *Anthus trivialis* ..	1	..	10	..	12	23
44. Tawny Pipit, *Anthus campestris* ..	..	3	2	..	1	6
45. Blyth's Pipit, *Anthus godlewskii* ..	..	..	..	..	1	1
46. Brown Rock Pipit, *Anthus similis*	..	..	..	1	..	1
47. Yellow Wagtail, *Motacilla flava* ssp.	1	..	..	123	680	804
48. Pied, or White, Wagtail, *Motacilla alba* ..	1	..	..	159	1	161
49. Blackheaded Yellow Wagtail, *Motacilla f. melanogrisea* ..	..	..	..	153	..	153
50. Yellowheaded Wagtail, *Motacilla citreola* ..	..	..	..	32	..	32
51. Common Rosefinch, *Carpodacus erythrinus* ..	13	1	1	..	27	42
52. Blackheaded Bunting, *Emberiza melanocephala* ..	249	6	4	1	..	260
53. Redheaded Bunting, *Emberiza bruniceps* ..	..	..	..	..	14	14
54. Striolated Bunting, *Emberiza striolata* ..	..	..	15	..	..	15
55. Greynecked Bunting, *Emberiza buchanani* ..	12	3	20	1	..	36

Field Survey: Assam, 11 to 29 November 1961

As indicated earlier our knowledge of bird migration has been very meagre. Unlike NW. India which, on account of its strategic importance, has enjoyed the benefit of many knowledgeable ornithologists, chiefly British army and political officers, posted there for long periods in the last hundred years, the NE. frontier areas have suffered comparative neglect due to the absence of resident ornithologists. Such information as is available thence is the result of haphazard observations, mostly of botanical and zoological collectors who chanced to be working in various parts of the country at the appropriate seasons. But, meagre as they are, the data suffice to indicate that a considerable amount of movement occurs through the valleys of the Brahmaputra and its network of tributaries, and across some of the high mountain passes through the Himalayan barrier between Tibet and Indian territory.

Recent efforts for extending our field work elicited certain suggestive clues that seemed worth following up. Two of the areas, one in NEFA, the other in the North Cachar hills, seemed particularly promising. Accompanied by Mr. E. P. Gee of Shillong, a member of the Society's Advisory Committee, I visited the areas from 11-29 November 1961 for a personal investigation of their possibilities.

1. *Tuting*, roughly 29° N. × 95° E., the headquarters of the Assistant Political Officer of the Siang Frontier Division, lies at an altitude of about 2000 ft. in an elongated crater-like valley, *c.* 2-3 miles long and 1.5 miles at its widest, running N. and S. through a titanic jumble of steep-sided heavily-forested Himalayas rising 9-12,000 ft. all round. The lower slopes of the mountains around the settlement are dotted sparsely here and there with clearings for the shifting cultivation of the local Abors. Within the valley is situated the P.S.S.-covered airstrip on which Dakotas of the Kalinga Airlines periodically land with supplies for the outpost. Before the airstrip was made a few years ago, the journey to Tuting meant 14 days' marching on foot from Pasighat; now the plane from Mohanbari airfield (Dibrugarh) took us there in 40 minutes. Our fellow travellers in this severely austere craft were mostly bags of atta and dal, tins of kerosene, drums of petrol and oil, and such other supplies. Flying with the doors wide open was a novel experience in air travel and added to the thrill of the endless succession of peaks, ridges, and perilous gorges below. The gigantic snow-covered mountains flanking the route did sometimes seem a bit too